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CLAIMS

What is claimed is:

1. A process for the manufacture of injection molded articles, in particular, for the manufacture of toothbrush bodies or toothbrushes by injection molding, wherein injection material from a raw material supply container (3) is transported by an injection unit (2) or a similar material conveying system to mold cavities (5), and whereby at least one additive is added to the injection material downstream from the injection unit (2) in a flow direction, characterized in that the at least one additive material is introduced by at least one additive feed directly in a distribution or conveyance channel in at least one channel subdistributor and/or a channel main distributor of a distribution channel arrangement and/or in a nozzle connected to a mold cavity, and in that the injection material and the additive material are mixed behind the point of entry of the additive feed (10) in the flow direction.

2. A process in accord with Claim 1, characterized in that the additive material or materials, which can be added to the injection material singly or in combination, comprise color (8), preferably in liquid form, granulates, powder, metal platelets, protection or reinforcement materials, deformation material, and chemically active additive substances such as foaming agents for cellular structure hardening agents, softeners or the like.

3. A process in accordance with one of the Claims 1 or 2, characterized in that the additive material (8) is introduced in a plurality of locations of the distribution arrangement.

4. A process in accordance with one of the Claims 1 to 3, characterized in that the additive material (8) is metered to the injection material by dosages.

5. A process in accordance with one of the Claims 1 to 4, characterized in that the introduction of the additive (8) is blocked during a post-pressure phase of the injection molding process.

6. A process in accordance with one of the Claims 1 to 5, characterized in that the additive (8) is introduced to the injection material at approximately the same temperature as that of the injection material.

7. Process for manufacturing a distribution channel arrangement (4), in particular a hot channel distributor (100) for an injection molding machine, including the steps of:

providing a first layer (192) with a half (152) of a distributor or conveyance channel section (150);

providing a second layer (191) with another half (153) of the distributor or conveyance channel section (150);

providing a mixer arrangement with at least one mixer (450);

locating the mixers (450) in the distribution or conveyance channel (150) between the first and second layers (192, 191); and

connecting the first layer and second layers (191) together.

8. An injection molding machine for the manufacture of injection molded articles, in particular of toothbrush bodies, with an injection molding die (1) and an injection unit (2) mold cavities (5), a distributor channel arrangement (4) with distributor or conveyance

channels (150) that carry injection material between the injection unit (2) and individual mold cavities (5) and at least one mixing apparatus (450) for the injection material, and at least one connection for an additive line, in particular for carrying out the process in accordance with one of claims 1 to 7, characterized in that the mixing apparatus and the additive line are integrated into the distributor channel arrangement (4, 4a, 100), and

that the mixing apparatus is part of the distributor or conveyance channels (150) of the distributor arrangement (4) and that the additive feed(s) for the additive (8) is (are) connected to the channel main distributor (6) or the channel subdistributor (14) connected to the injection unit (2) and/or in a nozzle connected to the mold cavity.

9. An injection molding machine in accordance with Claim 8, characterized in that an additive feed (10) outlet is provided within a nozzle (7) which extends into a mold cavity (5) and in that advantageously, the additive outlet is placed coaxially within the nozzle and terminates at the nozzle outlet end.

10. An injection molding machine in accordance with one of the Claims 8 or 9, characterized in that the feed (10) for the additive material (8) can be closed, preferably by means of shutoff valves (15).

11. An injection molding machine in accordance with one of the Claims 8 to 10, characterized in that the shutoff valve (15) is designed as a dosage valve for the additive material (8).

12. An injection molding machine in accordance with one of the Claims 8 to 11, characterized in that in a case of a plurality of line connections for additives (8), at least one is connected directly to a mold cavity (5).

13. An injection molding machine in accordance with one of the Claims 8 to 12, characterized in that the mixing apparatus includes at least one mixing chamber (17) formed by a cross-sectional change, preferably by a cross-sectional expansion.

14. An injection molding machine in accordance with one of the Claims 8 to 13, characterized in that a hot channel distributor (100) is provided for handling of melts (101), which, before injection into the mold cavities have been mixed with at least one additive material, and the hot channel distributor (100) includes a melt channel (150) arrangement, in which at least one feed line section (151) is provided for delivery of the additive material (102), an additive material line, with a terminating outlet into the feed line section (151), at least one mixer (300) aligned in a direction of flow, and in that the mixer (300) is formed as a mixing section which includes at least two sections (301, 302), the axes of which are not aligned to coincide with one another.

15. An injection molding machine in accordance with Claim 14, characterized in that the hot channel distributor (100) is a connectable main distributor incorporating distributor (140) with a plurality of subdistributors (130), the melt channel (150) of which, branches to the individual subdistributors (130), and said distributor (140) connects to an additive line (200) that exits into the feed line (151) followed by mixer (300) placed in the direction of flow and branches respectively to one or more subdistributors (130) at a connection point (131).

16. An injection molding machine in accordance with Claim 14, characterized in that the hot channel distributor (100), which is provided as a connectable subdistributor with a plurality of hot runner nozzles (160) and includes a subdistributor 130 and the melt channel (150), branches to the additive line (200) which flows into the feed line section (151) as well as to the mixer (300) which is placed in the direction of flow before a branching (161) leading to the hot runner nozzles (160).

17. An injection molding machine in accordance with one of the Claims 15 or 16, characterized in that by the use of a plurality of mixers (300) the length and the cross-section of the single mixing sections are made equal for the attainment of balanced flow ratios.

18. An injection molding machine in accordance with one of the Claims 14 to 17, characterized in that the exit opening (303) of the first section (301) is connected to the entry opening (304) of the second section (302) of the two sections (301, 302), by a flow direction reversal fitting (305) of the melt channel (150), wherein the direction of flow in the first section (301) is essentially opposite to the direction of flow in the second section (302).

19. An injection molding machine in accordance with Claim 18, characterized in that the exit opening (303) of the first section (301) is connected with the entry opening (304) of the second section (302) by means of a 180° turn-around fitting (305), whereby the two sections (301, 302) of the mixing length are made to be parallel to one another.

20. An injection molding machine in accordance with Claim 19, characterized in that the hot channel distributor (100) is constructed of at least two horizontal planes (170, 180)

placed one upon another, whereby the first section (301) is provided in the lower, first plane (170) and the second section ((302) is provided in the upper, second plane (180).

21. An injection molding machine in accordance with Claim 20, characterized in that the hot channel distributor (100) is divided along the two planes (170, 180) into a lower, a middle and an upper layer (190, 191, 192), whereby in each layer, (190, 191, 192) grooves are provided, and whereby, after the soldering of the layers (190, 191, 192) by a vacuum diffusion process, the grooves of adjacent layers (190, 191) and (191, 192) form, respectively, lower and upper halves (152, 153) of the melt channel (150).

22. An injection molding machine in accordance with one of the foregoing Claims, characterized in that the first and the second sections (301, 302) are respectively provided as static mixers (450).

23. An injection molding machine in accordance with Claim 22, characterized in that the two static mixer elements (450) in the lower or the upper half (152, 153) of melt channel (150) are installed directly in the melt channel (150), i.e. are soldered therein.

24. An injection molding machine in accordance with at least one of the Claims 22 and 23, characterized in that the two static mixers elements (450) comprise a plurality of screw shaped, twisting deflection plates (451, 452), which are arranged alternately right and left behind one another, wherein each deflection plate (451) possesses two edges (453) standing at right angles to the material flow direction, which are connected with the respective adjacent edge (454) of the neighboring deflection plate (452), and are turned through a specified angle in relation to said edge (454).

25. An injection molding machine in accordance with Claim 24, characterized in that the edges (453, 454) which are connected together are turned at an angle of 90° from one another.

26. An injection molding machine in accordance with Claim 24 or 25, characterized in that the adjacent edges (453, 454) of neighboring deflection plates (451, 452) are connected together by spot welding.

27. An injection molding machine in accordance with Claim 14, characterized in that in the feed section (151) an endpiece (201) of the additive line (200) penetrates coaxially into the melt channel (150) thereby forming an annular opening (202) between the outer wall of the endpiece (201) and the inner wall of the melt channel (150) to allow flow of melt.

28. An injection molding machine in accordance with Claim 27, characterized in that a diameter of the endpiece (201) of the additive line (200) is smaller than a diameter of the part of the additive line (200) which is connected to the endpiece (201).

29. An injection molding machine in accordance with Claim 14, characterized in that the additive line (200) is connected to a reservoir and a high pressure pump, which pumps the additive material (102) to be mixed out of the said reservoir into the endpiece (201) of the additive line (200) and further into the melt channel (150) at a sufficiently high pressure.

30. An injection molding machine in accordance with Claim 29, characterized in that the pressure generated by the high pressure pump is at least as high as the pressure force in the melt channel (150) at the injection point.

31. An injection molding machine in accordance with Claim 30, characterized in that the pressure generated by the high pressure pump is between 1000 bar and 1500 bar.

32. An injection molding machine in accordance with Claim 29, characterized in that the endpiece (201) of the additive line (200) can be closed by a needle valve (203) for the dosing of the additive (102), and the said needle valve (203) is intermittently controllable.

33. An injection molding machine in accordance with Claim 32, characterized in that a solenoid (204) activates the needle valve (203) at a frequency of 30 to 100 cycles per second.

34. An injection molding machine in accordance with Claim 32 or 33, characterized in that the needle valve (203) travel is limited to 0.1 to 0.01 mm.

35. An injection molding machine in accordance with one of the Claims 8 to 34, characterized in that within the distribution channel, a separating distance to the entry point of an additive feed (10) from a mold cavity, is determined in consideration of a volume of the article to be produced by injection molding and by an anticipated volume of additive required for the article.

36. An injection molding machine in accordance with one of the Claims 8 to 35, characterized in that a temperature adjustment apparatus is provided for the additive 8, preferably by means of a heating installation placed at the additive material feed (10).

37. An injection molding machine in accordance with one of the Claims 8 to 36, characterized in that one or more distributor channel branches include one or more additive material feeds (10).

38. An injection molding machine in accordance with one of the Claims 8 to 37, characterized in that a plurality of additive feeds (10) are provided in a channel leading to the mold cavities (5) in the direction of flow, and in that the additive feeds (10) can be optionally closed.

39. An injection molding machine in accordance with one of the Claims 8 to 38, characterized in that the entry of the additive feed (10) at the distributor channel is designed as an annular opening.

40. An injection molding machine in accordance with one of the Claims 8 to 39, characterized in that the additive feed (10) includes a feed line (11), a material propelling means, which is preferably formed by a pump (12) as well as an additive storage container (13).

41. An injection molding machine in accordance with one of the Claims 8 to 40, characterized in that the additive includes at least one of the following: color (8), preferably in liquid form, granulates, powder, metal platelets, protective material, reinforcing material, mold release means, chemically active additives such as foam agents for cellular products, hardeners, softeners and the like.

42. An injection molding machine in accordance with one of the claims 8-41, characterized in that the mixing arrangement comprises a first layer (192) with a half (152) of a distributor or conveyance channel section (150) and a second layer (191) with another half (153) of the distributor or conveyance channel section (150), and the mixer arrangement includes a mixer (450) located between the first and second layers (192, 191), and the first and second layers (192, 191) are connected together.